Who is Minding the Gap?

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The question of "Who is Minding the Gap?" is particularly timely and relevant to our national science, technology, engineering, and mathematics (STEM) higher education reform efforts because the retention and persistence of an ever increasing number of women in STEM at the baccalaureate level is heavily dependent upon the number of women faculty represented at all professorial levels in STEM fields. Recent literature supports this notion and suggests that a critical mass of women faculty in postsecondary STEM education is necessary to adequately support the needs of women undergraduate students. In fact, Bettinger and Long (2005) have shown that one of the greatest influences on and determinants of success in STEM disciplines for women students is access to same-gender role models. Additionally, O'Neill (2002) reports that same-gender and same-race mentoring often involves stronger psychosocial support that may yield better career outcomes.

Admittedly, the representation of women in the academic STEM disciplines has increased over time. In the past ten years, the percentage of bachelor's degrees awarded to women in any given year has been approximately the same as the percentage of women in the United States. Moreover, the percentages of master's and doctoral degrees awarded to women have been steadily increasing and are nearing parity with the number of degrees awarded to men. It is tempting to assume from this aggregate data that extra efforts to increase the representation of women in the STEM fields are no longer necessary.

However, such cursory examinations of aggregate data overlook the fact that women faculty, and especially women faculty of color, are still far below the level of critical mass and that there are too few of these faculty to provide women students with sufficient access to preferred role models. These aggregate data also tend to mask other critical gaps related to the intersections of gender with race/ethnicity, levels of underrepresented minority women in upper professorial ranks, and underrepresentation in critical STEM fields linked to US economic growth and preeminence (fig. 1).

Figure 1. Percentage of Degrees Awarded and Faculty Positions Accounted for by Women in 20101

To more fully understand the complexities of the representation of women and women of color—specifically African American, American Indian, and Hispanic women—at all STEM academic levels, the Representation Index (RI) serves as a vital tool. We define the RI generally as a group's percent of representation in a category divided by the percent of representation of that group in the US population. Specifically for this article,

an RI equal to one implies equal representation compared to representation in the US population, an RI larger than one indicates that women are overrepresented, and an RI of less than one indicates women are underrepresented.

Equation

In this way, the RI demonstrates not only representation, but also the magnitude of over- or underrepresentation. While some groups of women are well-represented in terms of degrees awarded in science and engineering (S&E) fields, all women tend to be underrepresented among the faculty ranks in these disciplines, and their representation decreases as educational attainment level and professorial rank increase. Figure 2 outlines the RI for women in various disciplines. The RI for women at the rank of full professor is less than 0.8 in every discipline, and is even below 0.2 in computer science and engineering. Even in psychology, where women were awarded 77 percent of all undergraduate degrees in 2010 and held 55 percent of all faculty positions, they are underrepresented at the full professor level.

Figure 2. Representation Index for All Women by Degrees Awarded and Faculty Rank, 20101

The underrepresentation of women in the academic STEM disciplines is further compounded by the intersection of gender with race and ethnicity (fig. 3). White women and women of Asian/Pacific Island descent are, as a group, well-represented among degrees awarded in S&E as well as entry-level faculty positions, while women of color are very much underrepresented in these fields at every level of degrees awarded and faculty rank. Further, the rate of underrepresentation steadily becomes more severe at higher professorial levels, resulting in the near invisibility of women of color at the full professor level.

Figure 3. Representation Index for Women of Color by Degrees Awarded and Faculty Rank, 2010 1,2

The RI for women of color at the full professor rank is 0.08 for all S&E fields. In other words, more than twelve times as many women professors of color are needed in the academic S&E fields to achieve parity with their representation in the US population. Additionally, an RI of 0.40 for women of color in the physical sciences and mathematics at the bachelor's degree level indicates that, as a group, two and a half times as many bachelor's degrees are needed in these fields for women of color to be represented in a proportion equal to that of the US population. In engineering, five times as many degrees at all levels would have to be awarded for parity to be achieved. While these women, as a group, are well represented in psychology and the social sciences at the level of bachelor's and master's degrees, the remaining S&E disciplines would have had to award this group twice as many bachelor's degrees and three times as many doctoral degrees in 2010 to be represented in proportions equal to the general population.

Overall, the discipline-specific gaps in the underrepresentation of women in the academic STEM disciplines not only negatively affect the academy's capacity to ultimately contribute to the STEM workforce, but also threaten to reduce quality of life for a significant portion of the current workforce. If the United States is to remain a competitive leader in science and engineering, it needs to rely on the talents of all of its citizens. Page (2007) points out that diversity among a group of problem solvers is more important than individual excellence, and that groups which display a diverse range of perspectives outperform groups of like-minded experts. If women are not participating equally in the S&E fields that pay the highest wages, the income disparity between men and women (Chang 2010) is not likely to improve. Forbes (2013) recently listed its "Top Ten STEM Occupations," as rated by income and employment outlook. All top ten occupations—with the exception of intelligence analyst, which ranked ninth in the list—are in engineering and computer science fields. These are exactly the disciplines, along with mathematics and the physical sciences, where women are most underrepresented.

The need for collective action by federal agencies, professional and philanthropic organizations, and higher education is immediate and urgent if we are to not only mind the gap, but also fill it. Several collaborations that are designed to begin to fill the gap exist at the National Science Foundation. The Historically Black College and Universities Undergraduate Program (HBCU-UP) and the ADVANCE Program have jointly funded projects to specifically address the unique issues of women faculty at historically black colleges and universities. The Opportunities for UnderRepresented Scholars (OURS) program at the Chicago School of Professional Psychology has developed and is delivering a graduate certificate program in academic leadership. OURS is designed to address the compelling need for women faculty in STEM disciplines at HBCUs to acquire leadership skills for academic roles either within their discipline or within institutional administrations. The first cohort of almost twenty women faculty is scheduled to receive the graduate certificate this spring and a second cohort has been selected. Already, in the programs first year of existence, over 25 percent of these participants have been promoted into leadership positions. Secondly, the Preparing Critical Faculty for the Future project at the Association of American Colleges and Universities supports women faculty at HBCUs in leading institutional change projects that target pedagogical change in the STEM disciplines. Additionally, the annual STEM Women of Color Conclave, grounded in the Entropic Career Identity Model (Mack et al. 2013), has served, since 2009, as a catalyst for helping women of color achieve STEM career identity and full integration in the STEM fields at all faculty levels. The conclave is attended by women and men from all STEM disciplines across all academic ranks and administrative positions and, to date, represents the largest convening of STEM women faculty of color in the nation.

The question "Who is minding the gap?" is meant to provoke thought, discussion, and scholarly pursuit in order to advance research, identify best practices, and implement solutions. Only research studies that fully take into account race/ethnicity, gender within race/ethnicity, STEM disciplines, and academic rank will be useful, particularly as the demographic landscape of higher education changes. No longer can failure to disaggregate data be an option if true reform is to occur in the United States.